



Valley
POWER SYSTEMS, INC.

AUTHORIZED DISTRIBUTOR
ELECTRO-MOTIVE

NEW 144-AUTO FERRIES PROJECT
4420 14TH AVENUE NW – SEATTLE, WA 98107 Tel. 206-834-2329 Fax. 206-782-5455

Calculation 4-DOC-009 Rev. –
(Formerly P-0291-09)

Contract 00-6679

ENGINEERING DATA

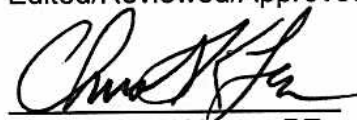
REDUCTION GEAR FLUSHING REQUIREMENTS AFTER LONG-TERM STORAGE

Application Note

Before actual performance of the first flush, the PSI Contractor as authorized by WSF will review these flushing requirements in detail and otherwise provide technical guidance to the Shipyard for successful accomplishment of these requirements.

Submitted by: The Falk Corporation

Edited/Reviewed/Approved by:

 3/30/06
Christopher K Lane, PE Date

Washington State Ferries New 144-Auto Ferry Program

PROPULSION SYSTEM CONTRACT No. 00-6679

REDUCTION GEAR DATA SHEET

REDUCTION GEAR FLUSHING PROCEDURE PRIOR TO START-UP

REFERENCES AND AUTHORITY:

This procedure is provided to assist the Shipyard in properly flushing the reduction gears generally, and particularly after extended storage that involves use of preservatives that make the flush requirements somewhat unusual. Regardless of the special procedures required to deal with these preservatives, the underlying requirement is to establish a condition of cleanliness that complies with the requirements of WSF Outline Specifications Section 74.

BACKGROUND AND PROCEDURE:

Where a reduction gear has been packaged for long term storage at the factory or otherwise according to Falk Gear requirements, internal surfaces will have been coated with Esgard PL2 preservative and a vapor phase rust inhibitor, Motorstor VCI-10, applied.

WARNING: Prior to start-up of the engines and reduction gears, the reduction gears must be prepared for operation per the following flushing procedure.

In addition to normal flush of the main reduction gear lube oil system and cleanliness certifications as required by WSF specifications and otherwise per normal industry practice, the following procedure on flushing is required by the gear manufacturer. It is recognized that there are variations to this procedure which can also result in satisfactory flushing but those will require specific approval by the WSF Engineering.

WARNING: Main reduction gear must be "Locked" by use of mechanical means to prevent rotation during maintenance and inspections.

CAUTION: Before releasing mechanical shaft lock and rotating main reduction gear, ensure that no personnel or equipment are inside reduction gear and/or near any component that will rotate.

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a) Main Reduction Gear Preparation

1. Remove any Marvellum wrapping from the external shaft surfaces.
2. Using mineral spirits, remove the Tectyl 890 from all external shaft extensions and machined surfaces.
3. Remove heavy grease from labyrinth seals on all shaft extensions.

b) Main Reduction Gear Hot Oil Lance

1. Prior to hot oil lance and flushing of the main reduction gear, all shipyard piping going to and from the main reduction gear must be flushed with the main reduction gear jumpered out of the system. No lube oil or flushing oil is to go into the main reduction gear until flushing of the shipyard piping is complete.
2. Working through inspection openings, use hot oil lance to remove preservative from gearing, shafts, and internal housing. Release shaft lock (whichever means utilized to lock shaft from rotating), and rotate output shaft through at least one revolution during the hot oil lance. Rotate both input shafts during hot oil lance at least one revolution to ensure all preservative is removed from input shafts. Install emergency come-home bolts into either of the input clutches. Now the clutch transfer gears can be rotated by again rotating the respective input shaft. Ensure complete removal of oil preservative.
3. Following hot oil lance, remove the oil from the system. All cleansing oil and preservative from the hot oil lance is to be removed from the main reduction gear sump. Hand clean the sump and inspect before closing.

c) Flushing Oil Type

1. Flushing oil type shall be same grade and manufacture, but of a lighter viscosity than that used for final operation.
2. Flushing oil can be stored and re-used for flushing on follow-on vessels.

d) Temperature of Oil During Flush

1. Maintain oil temperature between 140°F – 150°F.

e) Main Reduction Gear Flush

1. Fill the main reduction gear sump with the proper type, grade and quantity of flushing oil. See c) above.
2. The main reduction gear has been stored with both the high pressure filter and duplex filter elements removed. Insert all filter elements.
3. Start the electric motor driven lube oil pump and begin circulating lubrication oil. Circulate lube oil for two (2) hours, ensuring to switch duplex filters over every thirty (30) minutes. Clean elements when required, by observing the filter's visual bypass indicator. Following completion of two (2) hour flush, shut down electric motor driven pump and clean all filter elements.
4. After cleaning all filter elements, re-start electric motor driven lube oil pump and continue flush. Using the output shaft flange, rotate the low speed output shaft and main bull gear one turn every half hour. Flush main reduction gear for a total of eight (8) hours, or until no further debris or preservative is found in filters.

f) Completion of Flush, Inspection of System

1. Following all flush cycles, again clean all filter elements.
2. Remove flush oil from reduction gear sump, and heat exchanger.
3. Open sump clean-out cover and visually inspect sump for any sludge. Clean as necessary. Replace clean-out cover.
4. Place final charge of lube oil in reduction gear, and start electric motor driven lube oil pump. Visually inspect all spray bars through inspection openings and ensure all sprays are open and functioning and circulate for not less than two-hours.
5. Shut down pump, replace all inspection covers and change all oil filters that have been in service during these flushing evolutions.
6. Unit is now ready for operation with main engine.